# BROWNFIELDS AND GREENFIELDS ASSESSMENT METHOD IN RELATION TO VALUE POTENTIAL AND EFFICIENT USE

***Zuzana Dvořáková Líšková[1], Nikola Sagapova[2], Roman Buchtele[3]***

[1] *University of South Bohemia in České Budějovice, Faculty of Economics, Department of Regional Management and Law, Czech Republic, ORCID: 0000-0003-1788-6808, zuli@ef.jcu.cz;*
[2] *University of South Bohemia in České Budějovice, Faculty of Economics, Department of Regional Management and Law, Czech Republic, ORCID: 0000-0003-1628-7758, sagapova@ef.jcu.cz;*
[3] *University of South Bohemia in České Budějovice, Faculty of Economics, Department of Regional Management and Law, Czech Republic, ORCID: 0000-0003-0851-1318, buchtr01@ef.jcu.cz.*

***Abstract:*** *Brownfields and greenfields are examples of areas that report partial, however rather significant changes in the spatial organization of localities of economic and sometimes social changes. A large part of them emerged in areas originally used for industrial production and other economic activities, including former agricultural primary production. In the case of investor interest and with the support of the public sector, they can be transformed back into an area of growth and prosperity; which is discussed as the main motivation for writing the paper. The cost of reusing of such areas is in many cases very high and it is therefore necessary to find a suitable methodological tool to assess the suitability of revitalization and cultivation. The paper presents a newly proposed method for evaluating brownfields and greenfields in terms of their value potential and the way they can be further effectively utilised. Practical verification of the method was carried out at two localities (a brownfield in the village of Želeč and a greenfield in the village of Vidov) from the South Bohemian Region. Both test sites were comparable in terms of their possible future use (e.g., housing, civic amenities, greening). The potential of the tested sites was determined by means of the preference index and the most effective solutions for both areas of interest were proposed. Both localities could be interesting for investors, entrepreneurs and people with higher income. The obtained results demonstrate the suitability of the proposed method for the evaluation and decision-making on the further use of brownfields and greenfields in the Czech Republic.*

***Keywords:*** *Brownfields, greenfields, evaluation, decision-making, assessment method.*

***JEL Classification:*** *O18, R11, R14.*

***APA Style Citation:*** Dvořáková Líšková, Z., Sagapova, N., & Buchtele, R. (2022). Brownfields and Greenfields Assessment Method in Relation to Value Potential and Efficient Use. *E&M Economics and Management, 25*(4), 73–84. https://doi.org/10.15240/tul/001/2022-4-005

## Introduction

Brownfields (greenfields) are defined as the areas with a significant change in the past from sites with intensive use to sites with limited use, further to under-utilized and abandoned areas (De Sousa, 2003; Frantál et al., 2013; Syms, 1999). Brownfields are generally classified as the sites with a high probability of substantial changes. Marcuse and van Kempen (2000) use the term 'soft locations' for such sites. Brownfields are the sites characterized by abandonment, discontinuation of production and often associated with land contamination (Jetmar, 2008; Kirschner, 2005; Lange & Mc Neil, 2004). This fact may lead to the loss of value of such property accompanied by a decrease in the land price, an increase in unemployment, or increased costs of the clean-up (Čiháková Aguilar, 2009). Although brownfield sites are the post-industrial outcomes of various

anthropogenic activities and land use, the scarcity of land may play an important role in the attempts of finding new ways of utilization, redevelopment, and restoration of such areas based on their evaluation with regard not only to environmental issues but also sustainable development (Ahmad et al., 2018). Tackling the issue of brownfields and greenfields is crucial in the context of further local and regional sustainable development, and these localities may become new sites of progress and modernization (Pavolová et al., 2021). Brownfield assessment is necessary to achieve a sustainable redevelopment, which makes economic sense (Schädler et al., 2011). Due to the high financial costs and financial risk for the remediating and redeveloping of these areas, especially when it comes to industrial brownfield sites and projects, amplified by the issues of valuing the multiple benefits of their reuse, it is very difficult to find new, efficient ways of using them (De Sousa, 2000; Bardos et al., 2016). The aim of this paper is to provide and verify an assessment method for evaluating brownfields and greenfields in terms of their value potential and the way of their further effective utilization.

## 1. Theoretical Background

Literature on brownfields primarily presents approaches to their delineation, where a predominance of opinion and diversity is predominant, the causes of their origin and approaches to determine their extent and current status are specified (Alker et al., 2000; Bartke et al., 2016; Coffin, 2003; Jackson, 2003; Oliver et al., 2005; Syms, 2004).

Another part of the research is focused on the relations between brownfields and their non-investment use (Chalmers & Roehr, 1993; Hurd, 2002; Meyer, 2003; Mundy, 1992; Syms, 2004; Wiltshaw, 1998). Much attention is also paid to the issue of brownfield regeneration and the involvement of different profit and non-profit, state, and private organizations in this process (Alker et al., 2000; Lange & Mc Neil, 2004; Nappi-Choulet, 2006; Syms, 2004).

The adequacy of tools and policies and mechanisms to support the regeneration of these areas is assessed, barriers to the process of their regeneration and revitalization are specified (Adams et al., 2001; Syms, 2004; Faltejsek et al., 2016), together with the role of local governments and the public sector in this process (Doucet, 2010; Heberle & Wernstedt, 2006). Many current plans for dealing with brownfield sites are market-driven or prioritised by the public sector and do not take into account the wishes of residents and visitors (Martinat et al., 2018). The different approach in the definition and solution of brownfields (greenfields) is evidenced by non-uniform terminology, both at the national and international level. As examples, the terms brownfield, soft location, blackfield, depressing zone, dead zone (especially for contaminated sites) are used (Adams & Watkins, 2002; Dorsay, 2003; Marcuse & van Kempen, 2000; Svobodová & Věžník, 2009). Public health and environmental justice issues are also discussed (Maantay & Maroko, 2018; Rowan & Fridgen, 2003).

There are considerably different opinions dealing with these areas between the EU countries in terms of state involvement related to the issue. The European countries see brownfield regeneration as an integral part of the sustainable development of the society (Dair & Williams, 2006; Dixon & Adams, 2008; Dorsay, 2003). Brownfields are gradually becoming a topical issue of society, especially in connection with regional development, agricultural transformation, suburbanization, as well as reurbanization and reindustrialization processes (Krejčí et al., 2021; Liu et al., 2014; Pavolová et al., 2021; Rink & Schmidt, 2021). The problem of devastated and under-utilized localities affects to a varying extent most European countries, especially those from the former Eastern Bloc, but each country deals with the issue in a different way. The objective reasons for a differentiated approach to the solution of these areas include a very significant typological differentiation of brownfields in the EU countries, different degrees of their degradation and contamination, their different cultural-technical value, and, last but not least, different historical development of the country (Loures, 2015). A scientometric analysis of brownfields research found that most research has been conducted in the USA, Canada, England, Germany and China, and while in the past researchers focused on heavy metals, remediation, redevelopment and sustainability, more recently the focus has been on management and biodiversity (Lin et al., 2019). Although the greening of brownfields has been addressed before, it has recently received more attention, especially in urban areas (Chowdhury et al., 2020; Zhong et al., 2020).

In the Czech Republic, brownfields have been addressed only marginally or as a part of other projects so far. As part of the research, the Ministry of Regional Development of the Czech Republic discusses the topic of "Brownfields as Non-Industrial Depressive Zones" by several research teams (MMR, 2016). At the national level, the CzechInvest government agency is significantly involved in the issue (CzechInvest, 2016). The National Brownfield Regeneration Strategy was carried out by this organization, including detailed search studies of brownfields in all regions of the Czech Republic (RRAJM, 2005). Between 1989 and 2004, many agricultural brownfields appeared, and a lot of them were used for non-agricultural purposes. Brownfields located in peripheral areas or near borders, were more likely to be abandoned in the long term. However, some brownfields were converted back to agricultural land after 2004, and many others were used for housing (Navrátil et al., 2019). As far as agricultural brownfields are concerned, in general larger brownfields, but also brownfields in areas with rather low price of agricultural land have higher probability to get regenerated. Their reuse for housing and agricultural purposes occurs more in areas with lower price of agricultural land, including the localities with lower soil quality (Navrátil et al., 2021). Surprisingly, there is evidence, that the use is often dependent on socio-economic context, and many sites re-used for agriculture are found in areas not suitable for intensive agriculture, while in the areas with best conditions for agriculture these sites are often used for non-agricultural production (Navrátil et al., 2020).

## 2. Research Methodology

After consultation with CzechInvest, two sites in the South Bohemian region were selected as test sites to verify the proposed method for assessing brownfields and greenfields in terms of their value potential and the way of their further effective use. The brownfield site in the village of Želeč in the district of Tábor and greenfield site in the village of Vidov in the district of České Budějovice were chosen. Although Želeč can be characterized as a typical rural area, while Vidov is a rural area in the hinterland, both test sites are comparable in terms of their possible future use (housing, civic amenities, greening). Using the proposed methodical procedure, the sample localities are compared. The innovative methodological procedure follows the methodologies of Dvořáková Líšková et al. (2011). The methodologies are based on a study of the German Ministry of the Environment (Doetsh et al., 1997). The proposed methodical procedure reflects the specifics of these areas in the Czech Republic (such as a strong degree of devastation, frequent contamination, vastness of areas, poor construction-technical condition, and cultural-historical value of the localities and often unclear ownership relations). The methodology of Dvořáková Líšková et al. (2011) was used for point evaluation of the sites; subsequently, the preference index for each evaluated site was defined.

### 2.1 Scoring

Scoring of the sites includes 21 parameters, which are divided according to three main criteria:

- The potential of the place in terms of a municipality;
- the potential of the benefits for the investor;
- and the change in the value of the site – public interest in brownfield regeneration.

The main evaluation criteria are further specified into the sub-criteria with the appropriate scoring scales.

As shown in Tab. 2, each of the three sub-criteria has its own scoring range. For the potential of the place from the perspective of the municipality, the scoring scale is used for the sub-criteria of 0 points (worst) to 4 points (best). The investor's potential uses the scoring scale for sub-criteria of 0 points (worst) to 4 points (best). Changing the value of the site – public interest in brownfield regeneration uses a scoring scale of −2 points (worst) to 2 points (best). After assigning points to each sub-criterion for all three criteria, the sum of the points obtained is defined for each main criterion to determine whether a given site belongs to a group of high, specific, or minimum efficiency.

Based on the results obtained from the scoring, the preference index (PI) is calculated. PI is composed of the following variables: SP (site potential), UP (utility potential), $\Delta$ (scoring change), which arise from the product of weights and scoring for each criterion. The weights were assigned to the criteria based on an expert estimate in collaboration with an employee of the construction office, a construction company, and a real estate office manager.

**Tab. 1: Brownfield and greenfield scoring**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Potential of the place in terms of the municipality | Area size | Ease of construction | Time availability | Technical infrastructure | Transport infrastructure | Public transport | | |
| | 0 pts up to 4 pts | 1 pts up to 3 pts | 0 pts up to 4 pts | 0 pts up to 4 pts | 0 pts up to 4 pts | 0 pts up to 4 pts | | |
| Potential benefits in terms of the investor | Access to motorway | Location in the municipality | Restrictions on urban development | Regulations of regional planning | Liability | Attractiveness | Availability of labour forces | Presence of strong ec. subjects |
| | 0 pts up to 4 pts | 0 pts up to 4 pts | 0 pts up to 4 pts | 1 pts up to 3 pts | 0 pts up to 4 pts | 0 pts up to 4 pts | 1 pts up to 4 pts | 1 pts up to 4 pts |
| Changing the value of a place, public interest in brownfield regeneration | Site compatibility | Air quality | Microclimate | Urban development influence on the neighbourhood | Additional effects | Tourism | Spatial functionality | |
| | −1 pts up to +1 pts | −1 pts up to +1 pts | −1 pts up to +1 pts | 0 pts up to +2 pts | −2 pts up to +2 pts | −1 pts up to +1 pts | 0 pts up to +1pts | |

Source: own

**Tab. 2: Criteria evaluation**

| The potentials | Total parameters | Evaluation | Maximum points | Minimum points | Evaluation |
|---|---|---|---|---|---|
| Potential of the place in terms of the municipality | 6 | 0–4 points | 23 | 1 | High potential (H) 17–23 points<br>Specific potential (H)(S)11–16 points<br>Minimum public interest (M) 1–10 points |
| Potential benefits in terms of the investor | 8 | 0–4 points | 31 | 4 | High potential (H) 24–31 points<br>Specific potential (H)(S) 16–23 points<br>Minimum public interest (M) −6–0 points |
| Changing the value of a place, public interest in brownfield regeneration | 7 | −2 +2 points | 10 | −6 | High potential (H) 6–10 points<br>Specific potential (H)(S) 1–5 points<br>Minimum public interest (M) −6–0 points |

Source: own

The values of AC (area preparation costs), RC (cost of land remediation), and PL (selling price of land) scaling and the weights were also consulted with CzechInvest in České Budějovice.

The preference index defined by the following relation:

$$PI = \frac{2.5\sum g\ .\ SP + 1.0\sum n.\ UP + 6.5\sum w.\Delta}{(AC+RC)-PL} \quad (1)$$

The IP calculation results in the expected benefit in points per unit of cost. In the formula, *g* denotes the weights of the sub-parameters for the site potential factor (*SP*), *n* denotes the weights of the sub-parameters for the utility factor (*UP*), *w* denotes the weights of the sub-parameters for the site change factor (*SW*) from brownfield regeneration and negative externalities from greenfields), *AC* denotes the cost of land preparation, *RC* denotes the cost of land remediation, *PL* denotes the sale price of the land. The last three values are expressed in money per m$^2$ of land (Rydvalová & Žižka, 2006). This index defines which of the two sample locations is more suitable for investors. The larger the number of the preference index, the more suitable the site is, either for brownfield regeneration or for greenfield development. The regional specificities were taken into account in the calculation.

## 3. Research Results

The first calculation part was done by scoring the sites by Tab. 1 and 2. There are three evaluation criteria. 1. Calculation of the potential of the site in terms of the municipality – Brownfield (BR) **>** Greenfield (GR). 2. Calculation of the potential of the site in terms of the investor – Brownfield (BR) **>** Greenfield (GR). 3. Calculation of changing the value of the site – public interest in brownfield regeneration – Brownfield (BR) **>** Greenfield (GR).

### 3.1 Calculation of the Potential of the Site in Terms of the Municipality – BR > GR

The evaluation of the potential of the site from the point of view of the municipality was based on the evaluation of six parameters (sub-criteria). Based on the results, the potential is almost identical for both localities with a slight predominance for the brownfield site. Land size, construction ability, and time availability are almost identical for both assessed localities. There are significant differences in the technical and transport infrastructure and public transport.

**Tab. 3: Calculation of the potential of the site in terms of the municipality – BR > GR**

| Parameter | Weight | BR | BR Assessment | GR | GR Assessment |
|---|---|---|---|---|---|
| Land size | 0.02 | 0 | 0 | 1 | 0.02 |
| Ease of construction | 0.13 | 3 | 0.39 | 3 | 0.39 |
| Time availability | 0.1 | 4 | 0.4 | 2 | 0.2 |
| Technical infrastructure | 0.21 | 2 | 0.42 | 4 | 0.84 |
| Transport infrastructure | 0.5 | 4 | 2 | 3 | 1.5 |
| Public transport | 0.04 | 2 | 0.08 | 4 | 0.16 |
| **SP total** | **1** | **x** | **3.29** | **x** | **3.11** |

Source: own

### 3.2 Calculation of the Potential of the Site in Terms of the Investor Municipality – BR > GR

As shown in Tab. 4, the evaluation used a total of eight parameters and the result is similar to the potential of the municipality. The final sum of points achieved in both tested localities does not show any significant differentiation (0.26 points) in favour of brownfield. The point values are the same for six parameters, plus differentiation in favour of brownfield is only for labour availability, which is irrelevant at the time of low unemployment level.

**Tab. 4: Calculation of the potential of the site in terms of the investor – BR > GR**

| Parameter | Weight | BR | BR Assessment | GR | GR Assessment |
|---|---|---|---|---|---|
| Accessibility – motorway accessibility | 0.2 | 4 | 0.8 | 3 | 0.6 |
| Location within the municipality | 0.12 | 3 | 0.36 | 3 | 0.36 |
| Construction restrictions | 0.15 | 4 | 0.6 | 4 | 0.6 |
| Regulators according to zoning documentation | 0.16 | 3 | 0.48 | 3 | 0.48 |
| Liabilities | 0.15 | 4 | 0.6 | 4 | 0.6 |
| Attractiveness | 0.1 | 2 | 0.2 | 3 | 0.3 |
| Availability of labour force | 0.08 | 4 | 0.32 | 2 | 0.16 |
| The presence of strong industries and economic subjects | 0.04 | 2 | 0.08 | 2 | 0.08 |
| **UP Total** | **1** | **x** | **3.44** | **x** | **3.18** |

Source: own

**Tab. 5: Calculation of changing the value of the site – public interest in brownfield regeneration – BR > GR**

| Parameter | Weights w | BR before | BR after | Δ | wΔ |
|---|---|---|---|---|---|
| Site contamination | 0.32 | −1 | −1 | 0 | 0 |
| Air quality | 0.11 | 1 | 0 | −1 | −0.11 |
| Microclimate | 0.1 | 1 | 1 | 0 | 0 |
| Development of the urban area and its impact on the surroundings | 0.25 | 0 | 0 | 0 | 0 |
| Additional effects | 0.06 | 1 | 2 | 1 | 0.06 |
| Tourism | 0.12 | 1 | 1 | 1 | 0.12 |
| Space functionality | 0.04 | 1 | 2 | 1 | 0.04 |
| **SW total** | **1** | **x** | **x** | **x** | **0.11** |
| **Parameter** | **Weights w** | **GR before** | **GR after** | **Δ** | **wΔ** |
| Site contamination | 0.32 | −1 | 1 | 0 | 0 |
| Air quality | 0.11 | 1 | 0 | −1 | −0.11 |
| Microclimate | 0.1 | 1 | 1 | 0 | 0 |
| Development of the urban area and its impact on the surroundings | 0.25 | 1 | 2 | 1 | 0.25 |
| Additional effects | 0.06 | 2 | 1 | −1 | −0.06 |
| Tourism | 0.12 | 1 | 0 | −1 | −0.12 |
| Space functionality | 0.04 | 2 | 2 | 0 | 0 |
| **SW total** | **1** | **x** | **x** | **x** | **−0.04** |

Source: own

### 3.3 Changing the value of the Site – Public Interest in Brownfield Regeneration – BR > GR

Regarding the public interest in the regeneration of the tested areas, eight parameters were used and a fundamental point difference between the tested areas was found. A favourable result was achieved again for the brownfields. In relation to the greenfields, a negative sum of points was achieved, i.e., the public had a negative opinion on regeneration and subsequent use of the area.

### 3.4 Summary Evaluation of Potential of the Sample Areas

Evaluating both test areas together using Tab. 2 revealed that the brownfield site (Chateau in the village of Želeč) is possibly a suitable area, mainly due to the higher public interest in its regeneration. In terms of potential investor benefits, the result is the same in both areas, i.e., high, in terms of the municipality's potential interest in the brownfield site it is specific (revitalization and renewal of Želeč Chateau), and it is high in greenfield (single-family detached houses in Vidov).

**Tab. 6: Summary evaluation of brownfield potential (Želeč chateau)**

| Criterion | Sum of points | Potential |
|---|---|---|
| Potential of the place in relation to the municipality | 15 | Specific |
| Potential of benefit in relation to the investor | 26 | High |
| Changing the value of the site– public interest in brownfield regeneration | 2 | Specific |

Source: own

**Tab. 7: Summary evaluation of greenfield potential (detached houses in Vidov)**

| Criterion | Sum of points | Potential |
|---|---|---|
| Potential of the place in relation to the municipality | 17 | High |
| Potential of benefit in relation to the investor | 24 | High |
| Changing the value of the site – public interest in brownfield regeneration | −2 | High |

Source: own

### 3.5 Calculation of the Preference Index

Calculation of preference index is based on the following equation:

$$PI = \frac{2.5 \sum g \,.\, SP + 1.0 \sum n \,.\, UP + 6.5 \sum w \,.\, \Delta}{(AC + RC) - PL} \quad (2)$$

*Brownfield Preference Index in the Village of Želeč*

The calculation is made for 2011 and 2018. Input parameters for calculation (RC value (remediation costs) is 350/550 CZK/m², AC value (cost of infrastructure strengthening) are 200/450 CZK/m² and PL (brownfield price) is 75/120 CZK/m².

$$PI\ (2011) = \frac{2.5\,.\,3.29 + 1.0\,.\,3.44 + 6.5\,.\,0.11}{475} = \quad (3)$$
$$= 0.0261\ pts/\ CZK$$

$$PI\ (2018) = \frac{2.5\,.\,3.29 + 1.0\,.\,3.44 + 6.5\,.\,0.11}{880} = \quad (4)$$
$$= 0.0141\ pts/\ CZK$$

*Greenfield Preference Index (Detached Houses in Vidov)*

The calculation is made for 2011 and 2018. Input parameters for calculation (RC value (remediation costs) is 350/450 CZK/m², AC value (cost of infrastructure strengthening) is 200/500 CZK/m² and PL (brownfield price) is 15/800 CZK/m².

$$PI\ (2011) = \frac{2.5\,.\,3.11 + 1.0\,.\,3.18 + 6.5\,.(-0.04)}{535} = \quad (5)$$
$$= 0.0199\ pts/\ CZK$$

$$PI\ (2018) = \frac{2.5\ .\ 3.11+1.0\ .\ 3.18+6.5\ .(-0.04)}{150} = \quad (6)$$

$$= 0.0713\ pts/\ CZK$$

In order to verify the explanatory power of the proposed procedure, the PI calculation was performed for 2011 and 2018. In 2011, $PI_{BR} > PI_{GR}$ applied. In terms of cost, brownfield is described as a better location in the year. The opposite result was achieved in 2018, the greenfield location is clearly more advantageous as a result of significant changes in the real estate market in terms of land prices and generally the real estates.

## 4. Discussion

The results of the research in the paper, are discussed at two evaluation levels – in terms of theoretical and methodological contribution of the research and in terms of applicability of the results in practice.

### 4.1 Theoretical and Methodological Contribution

The proposed method for the evaluation of brownfields and greenfields in terms of their value potential and the way of their further effective utilization proved as a suitable application tool throughout the whole research and verification of the outputs.

In terms of the structure of the proposed method, consisting of basic three stages: point evaluation of the site according to three basic criteria with detailed sub-criteria, summary evaluation of the site from the perspective of all three levels, and the subsequent calculation of the preference index, it was proved to be a suitable general model.

In the following research, it seems necessary to divide the methodological procedure of the evaluation into two basic parts, in particular, the common basis of evaluation (including a general model of methodological procedure) and a specific part of the evaluation in accordance with the brownfield typology.

The specific part of the assessment for different individual types of areas needs to reflect the specifics (different origin, degree of disruption, social, cultural, and technical value, possibilities of regeneration, etc.). A unified procedure for all types of areas is not satisfactory and the presentation of the results is significantly limited, which was also reflected in the evaluation of the sites used in the paper. The need of emphasis on the specifics of the area in the assessment of the site with respect to sustainable regional development has been recognized by many authors (e.g., Dasgupta & Tam, 2009; Frantál et al., 2013; Novosák et al., 2013; Pavolová et al., 2019; Skrabal, 2020).

In the evaluation of the sites, it was necessary to complete it with other parameters, which were not known and not so conclusive at the beginning. It seems necessary to incorporate dynamic parameter criteria into the evaluation concerning both financial and economic area and the technical and territorial-administrative parameters including the environmental issues. The evaluation process is significantly affected by the situation in the real estate market, the economic cycle of the national economy, and, last but not least, the level, and in particular the will, of the state administration authorities to resolve and financially support this issue. The lack of known variables, which may result in a non-optimal investment decision, creates a stimulus of making and comparing several evaluation methods and investment alternatives (Brož, 2010). In economically strong areas with demand for space private investments can support the redevelopment of sites, however in economically weak areas the financial support from government spendings is needed to help to resolve this issue and trigger private investments (Kraft, 2005). In the Czech Republic, the influx of EU funding through the Real Estate Programme within the Operational Programme Enterprise and Innovation, had supported brownfields regeneration, and had attracted not only owners, but also investors to remediate and redevelop various brownfield sites (Doleželová et al., 2014).

### 4.2 Usability of the Results in Practice

Regarding the evaluation of the sites, the authors consider it necessary to complete partial specific criteria according to the area typologies and to increase the accent on the time parameter of the evaluation. This is evidenced by the results of the summary evaluation, when at the time of the first evaluation in 2011–2012 both sites showed approximately the same point and potential value.

Currently, due to the changes in economic, financial, and real estate parameters, the locality of Vidov, in the district of České Budějovice, is clearly stronger for the construction of family

houses. Transport accessibility, civic amenities, the infrastructure have been strengthened in this area, and the locality has become a valued investment opportunity by a land use plan for further civic use, and, to a lesser extent, for business.

This statement fully corresponds with the results of the preference index (in 2018, it unequivocally assessed greenfield as the most advantageous site). The weight of evidence would be even more pronounced if other specific criteria were added. For investors, this investment is financially interesting because of the deepening crisis in the housing stock, and the growing interest of the residents in moving to quiet locations outside large towns, with nature and recreation.

There is a positive impact of such investment even for the municipality as it will increase the population and thus the development of the area. There is currently an extraordinary interest in the land (approx. 3 ha), which is also in line with the conclusions in the paper. The whole complex is already parcelled and sold the owners. In the village of Vidov there is an increase in population, the reason is very close distance to the city of České Budějovice (7 km), as a catchment point of large companies, such as Bosch Ltd., Motor JIHOKOV Plc., Budvar n. c., and others.

The Želeč site has also recently undergone a fundamental change in the attitude of its use, particularly by the citizens and entrepreneurs. In this locality, the former chateau has not been used for many years and it is in a dilapidated state. The chateau building is complemented by more than 5 ha of unused area. Using the chateau for housing would be a good investment for the municipality. New citizens could come to the municipality to help develop the municipality. The great advantage of the site is that there is no soil contamination around the site and is not degraded in any way. Increasing interest in the regeneration of this site may be due to its location near the centre of the village on the one hand, and the lack of development areas on the other. It is assumed that the entrepreneurs and groups of people with higher income could be interested in this locality, as an alternative solution opens the possibility of use for health and social purposes.

## Conclusions

The brownfield issues have not yet been fully appreciated in the Czech Republic, although 2,355 sites are located with a total area of 10,326 ha, with only sites larger than 2 ha with a minimum built-up area of 500 $m^2$ recorded (CzechInvest, 2008). Greenfields occupy about 35% of this area. The ever-decreasing acreage of agricultural land resources, the gradual reduction of built-up areas in urban agglomerations for housing construction and civic amenities, the development of road and railway transport infrastructure, and a number of other related factors create a real need to deal with the issues discussed in the paper conceptually, effectively and with the support of the government.

It is assumed that the need for a solution to this issue has never been so necessary. This fact has led the authors to propose a methodological approach as a tool that could prevent an unorganized, non-conceptual solution that consists of demolition and degradation of the areas without prior research and analysis. The authors of the paper do not overestimate the results, besides the theoretical and methodological contribution of such research, they want to start a wide professional discussion on this issue. They want to draw the attention of both the state administration and the local government to the topicality and necessity of the solution and to contribute with the results to the practical solution.

***Acknowledgements:*** *Supported by the grant No. P402/10/P344 "Economic aspects of regeneration of brownfields in South-Bohemian region" of the "Czech Science Foundation".*

### References

Adams, D., Disberry, A., Hutchinson, N., & Munjoma, T. (2001). Ownership Constraints to Brownfield Redevelopment. *Environment and Planning A: Economy and Space, 33*(3), 453–477. https://doi.org/10.1068/a33200

Adams, D., & Watkins, C. (2002). *Greenfields, Brownfields & Housing Development.* Blackwell Science.

Ahmad, N., Zhu, Y., Ibrahim, M., Waqas, M., & Waheed, A. (2018). Development of a Standard Brownfield Definition, Guidelines, and Evaluation Index System for Brownfield Redevelopment in Developing Countries: The Case of Pakistan. *Sustainability, 10*(12), 4347. https://doi.org/10.3390/su10124347

Alker, S., Joy, V., Roberts, P., & Smith, N. (2000). The Definition of Brownfield. *Journal of Environmental Planning and Management, 43*(1), 49–69. https://doi.org/10.1080/09640560010766

Bardos, R. P., Jones, S., Stephenson, I., Menger, P., Beumer, V., Neonato, F., Maring, L., Ferver, U., Track, T., & Wendler, K. (2016). Optimising value from the soft re-use of brownfield sites. *Science of the Total Environment, 563–564,* 769–782. https://doi.org/10.1016/j.scitotenv.2015.12.002

Bartke, S. Martinat, S., Klusácek, P., Pizzol, L., Alexandrescu, F., Frantál, B., Critto, A., & Zabeo, A. (2016). Targeted selection of brownfields from portfolios for sustainable regeneration: User experiences from five cases testing the Timbre Brownfield Prioritization Tool. *Journal of Environmental Management, 184*(Part 1), 94–107. https://doi.org/10.1016/j.jenvman.2016.07.037

Brož, Z. (2010). Investment evaluation of brownfield redevelopment. In *Proceedings of the International Workshop for PhD Students*. 14 December, 2010. Brno, Czech Republic.

RRAJM. (2005). *Brownfieldy 2005 [Brownfields 2005]* (Situation Report for South Moravian Region). Regionální rozvojová agentura jižní Moravy [Regional Development Agency South Moravia]. Retrieved August 9, 2019, from http://rrajm.data.quonia.cz/brownfieldy/publikace/RV_situacni_zprava.pdf

Chalmers, J. A., & Roehr, S. A (1993). Issues in the valuation of contaminated property. *The Appraisal Journal; Chicago, 61*(1), 28–41. Retrieved from https://search.proquest.com/docview/199939676

Coffin, S. L. (2003). Closing the Brownfield Information Gap: Some Practical Methods for Identifying Brownfields. *Environmental Practice, 5*(1), 34–39. https://doi.org/10.1017/S1466046603030126

CzechInvest. (2008). *Základní statistické výsledky Vyhledávací studie brownfieldů [Basic statistical results: Brownfield search study]*. Retrieved August 9, 2019, from https://www.czechinvest.org/cz/Sluzby-pro-municipality/Nemovitosti-pro-podnikatelske-ucely/Brownfieldy

Čiháková Aguilar, S. (2009). Decision Making and Brownfield Management. *E&M Economics and Management, 12*(3), 19–32.

Dair, C. M., & Williams, K. (2006). Sustainable Land Reuse: The Influence of Different Stakeholders in Achieving Sustainable Brownfield Developments in England. *Environment and Planning A, 38,* 1345–1366. https://doi.org/10.1068/a37370

Dasgupta, S., & Tam, E. K. L. (2009). Environmental Review: A Comprehensive Review of Existing Classification Systems of Brownfield Sites. *Environmental Practice, 11*(4), 285–300. https://doi.org/10.1017/S1466046609990287

De Sousa, C. A. (2000). Brownfield Redevelopment versus Greenfield Development: A Private Sector Pespective on the Costs and Risk Associated with Brownfield Redevelopment in the Greater Toronto Area. *Journal of Environmental Planning and Management, 43*(6), 831–853. https://doi.org/10.1080/09640560020001719

De Sousa, C. A. (2003). Turning brownfields into green space in the City of Toronto. *Landscape and Urban Planing, 62*(4), 181–198. https://doi.org/10.1016/S0169-2046(02)00149-4

Dixon, T., & Adams, D. (2008). Housing Supply and Brownfield Regeneration in a post-Barker World: Is There Enough Brownfield Land in England and Scotland? *Urban Studies, 45*(1), 115–139. https://doi.org/10.1177/0042098007085104

Doetsch, P., Rüpke, A., & Burmeier, H. (1997). *Revitalisierung von Altstandorten versus Inanspruchnahme von Naturflächen [Revitalization of Old Sites Versus Use of Natural Areas]* (Research Report). Umweltbundesamt.

Doleželová, L., Hadlač, M., Kadlecová, M., Martinát, S., & Polednik, M. (2014). Redevelopment potential of brownfields: A-B-C classification and its practical application. *E&M Economics and Management, 17*(2), 34–44. https://doi.org/10.15240/tul/001/2014-2-003

Dorsay, J. V. (2003). Brownfields and Greenfields: The Intersection of Sustainable Development and Environmental Stewardship. *Environmental Practice, 5*(1), 69–76. https://doi.org/10.1017/S1466046603030187

Dvořáková Líšková, Z., Cudlínová, E., Dvořák, P., & Lapka, M. (2011). Evaluation of brownfields – on example of the South Bohemian region. *Acta Universitatis Bohemiae Meridionalis*, *14*(1), 135–142.

Doucet, B. (2010). *Rich cities with poor people: Waterfront regeneration in the Netherlands and Scotland* (Netherlands Geographical Studies 391). Utrecht University, Faculty of Geosciences.

Faltejsek, M., Szeligová, N., & Vojvodíková, B. (2016). Application of Facility Management Information Tools for Registration of Brownfields.

*Journal of Engineering and Applied Sciences, 11*(9), 2003–2008. https://doi.org/10.36478/jeasci.2016.2003.2008

Frantál, B., Kunc, J., Nováková, E., Klusáček, P., Martinat, S., & Osman, R. (2013). Location Matters! Exploring Brownfields Regeneration in a Spatial Context (A Case Study of the South Moravian Region, Czech Republic). *Moravian Geographical Reports, 21*(2), 5–19. https://doi.org/10.2478/mgr-2013-0007

Heberle, L., & Wernstedt, K. (2006). Understanding Brownfields Regeneration in the US. *Local Environment, 11*(5), 479–497. https://doi.org/10.1080/13549830600853064

Hurd, B. (2002). Valuing superfund site cleanup: Evidence of recovering stigmatized property values. *The Appraisal Journal, 70*(4), 426–437.

Chowdhury S., Kain, J.-H., Adelfio, M., Volchko, Y., & Norrman, J. (2020). Greening the Browns: A Bio-Based Land Use Framework for Analysing the Potential of Urban Brownfields in an Urban Circular Economy. *Sustainability, 12*(15), 6278. https://doi.org/10.3390/su12156278

Jackson, J. (2003). *Brownfields ABC: brownfields klasifikace a kategorizace [Brownfields ABC: brownfields classification and categorization].* Retrieved October 17, 2017, from http://www.brownfields.cz/wp-content/uploads/2008/04/brownfields-podrobna-abcklasifikace2003.pdf

Jetmar, M. (2008). *Aktuální témata regionálního rozvoje: průmyslové zóny a brownfield [Current topics of regional development: industrial zones and brownfield].* Jan Evangelista Purkyně University in Ústí nad Labem, Faculty of Social and Economic Studies.

Kirschner, V. (2005). *Klasifikace brownfields: studie k disertační práci Regenerace brownfields [Classification of brownfields: study for the dissertation Regeneration of brownfields].* Czech Technical University in Prague, Faculty of Architecture, Department of Spatial Planning.

Kraft, J. (2005). Úloha trhu při systematické revitalizaci brownfields [Role of the market in the systematic revitalization of brownfields]. *E&M Economics and Management, 9*(4), 28–33.

Krejčí, T., Navrátil, J., Martinát, S., Frazier, R. J., Klusáček, P., Pícha, K., Škrabal, J., & Osman, R. (2021). Spatial Unevenness of Formation, Remediation and Persistence of Post-Agricultural Brownfields. *Land, 10*(3), 325. https://doi.org/10.3390/land10030325

Lange, D., & McNeil, S. (2004). Clean It and They Will Come? Defining Successful Brownfield Development. *Journal of Urban Planning and Development, 130*(2), 101–108. https://doi.org/10.1061/(ASCE)0733-9488(2004)130:2(101)

Lin, H., Zhu, Y., Ahmad, N., & Han, Q. (2019). A scientometric analysis and visualization of global research on brownfields. *Environmental Science and Pollution Research, 26,* 17666–17684. https://doi.org/10.1007/s11356-019-05149-3

Liu, Y., van Oort, F., Geertman, S., & Lin, Y. (2014). Institutional determinants of brownfield formation in Chinese cities and urban villages. *Habitat International, 44,* 72–78. https://doi.org/10.1016/j.habitatint.2014.05.005

Loures, L. (2015). Post-industrial landscapes as drivers for urban redevelopment: Public versus expert perspectives towards the benefits and barriers of the reuse of post-industrial sites in urban areas. *Habitat International, 45*(Part 2), 72–81. https://doi.org/10.1016/j.habitatint.2014.06.028

Maantay, J. A., & Maroko, A. R. (2018). Brownfields to Greenfields: Environmental Justice versus Environmental Gentrification. *International Journal of Environmental Research and Public Health, 15*(10), 2233. https://doi.org/10.3390/ijerph15102233

Marcuse, P., & Van Kempen, R. (2000). *Globalizing Cities: A New Spatial Order?* Blackwell Publishing. https://doi.org/10.1002/9780470712887

Martinat, S., Navratil, J., Hollander, J. B., Trojan, J., Klapka, P., Klusacek, P., & Kalok, D. (2018). Re-reuse of regenerated brownfields: Lessons from an Eastern European post-industrial city. *Journal of Cleaner Production, 188,* 536–545. https://doi.org/10.1016/j.jclepro.2018.03.313

Meyer, P. B. (2003). Brownfield and Red Ink: The Costs of Contaminated (and Idle) Land. *Environmental Practice, 5*(1), 40–47. https://doi.org/10.1017/S1466046603030138

MMR. (2016). *Základní pojetí konceptu udržitelného rozvoje: Vývoj principů udržitelného rozvoje [The basic notion of the concept of sustainable development].* Ministry of Regional Development (Czech Republic). Retrieved January 27, 2016, from https://www.mmr.cz/cs/ministerstvo/regionalni-rozvoj/informace,-aktuality,-seminare,-pracovni-skupiny/psur/uvodni-informace-o-udrzitelnem-rozvoji/zakladni-pojeti-konceptu-udrzitelneho-rozvoje

Mundy, B. (1992). Stigma and Value. *The Appraisal Journal, 60*(1), 7–13.

Myers, D. (1988). Building Knowledge about Quality of Life for Urban Planning. *Journal of the American Planning Association, 54*(3), 347–358. https://doi.org/10.1080/01944368808976495

Nappi-Choulet, I. (2006). The Role and Behaviour of Commercial Property Investors and Developers in French Urban Regeneration: The Experience of the Paris Region. *Urban Studies, 43*(9), 1511–1535. https://doi.org/10.1080/00420980600831692

Navrátil, J., Krejčí, T., Martinát, S., Frazier, R. J., Klusáček, P., Pícha, K., Škrabal, J., & Osman, R. (2021). Variation in brownfield reuse of derelict agricultural premises in diverse rural spaces. *Journal of Rural Studies, 87,* 124–136. https://doi.org/10.1016/j.jrurstud.2021.09.004

Navrátil, J., Krejčí, T., Martinát, S., Pícha, K., Klusáček, P., Škrabal, J., & Osman, R. (2019). Abandonment or Regeneration and Re-Use? Factors Affecting the Usage of Farm Premises in Different Social Spaces of the Rural. *Sustainability, 12*(21), 9124. https://doi.org/10.3390/su12219124

Navrátil, J., Martinát, S., Krejčí, T., Pícha, K., Klusáček, P., Škrabal, J., & Osman, R. (2019). The fate of socialist agricultural premises: To agricultural 'brownfields' and back again? *Moravian Geographical Reports, 27*(4), 207–216. https://doi.org/10.2478/mgr-2019-0016

Novosák, J., Hájek, O., Nekolová, J., & Bednář, P. (2013). The Spatial Pattern of Brownfields and Characteristics of Redeveloped Sites in the Ostrava Metropolitan Area (Czech Republic). *Moravian Geographical Reports, 21*(2), 36–45. https://doi.org/10.2478/mgr-2013-0009

Oliver, L., Ferber, U., Grimski, D., Millar, K., & Nathanail, P. (2005). The Scale and Nature of European Brownfields. In *CABERNET 2005 – Proceedings of the 1st International Conference on Managing Urban Land*. Land Quality Management Press.

Pavolová, H., Bakalár, T., Emhemed, E. M. A., Hajduová, Z., & Pafčo, M. (2019). Model of sustainable regional development with implementation of brownfield areas. *Entrepreneurship and Sustainability Issues, 6*(3), 1088–1100. http://doi.org/10.9770/jesi.2019.6.3(2)

Pavolová, H., Bakalár, T., Tokarčík, A., Kozáková, Ľ, & Pastyrčák, T. (2021). An Economic Analysis of Brownfield and Greenfield Industrial Parks Investment Projects: A Case Study of Eastern Slovakia. *International Journal of Environmental Research and Public Health, 18*(7), 3472. https://doi.org/10.3390/ijerph18073472

Rink, D., & Schmidt, C. (2021). Afforestration of Urban Brownfields as a Nature-Based Solution. Experiences from a Project in Leipzig (Germany). *Land, 10*(9), 893. https://doi.org/10.3390/land10090893

Rowan, G., & Fridgen, C. (2003). Brownfields and Environmental Justice: The Threats and Challenges of Contamination. *Environmental Practice, 5*(1), 58–61. https://doi.org/10.1017/S1466046603030163

Rydvalová, P., & Žižka, M. (2006). Ekonomické souvislosti revitalizace brownfields [Economic context of revitalization of brownfields]. *Politická ekonomie, 54*(5), 632–645. https://doi.org/10.18267/j.polek.576

Schädler, S., Morio, M., Bartke, S., Rohr-Zänker, R., & Finkel, M. (2011). Designing sustainable and economically attractive brownfield revitalization options using an integrated assessment model. *Journal of Environmental Management, 92*(3), 827–837. https://doi.org/10.1016/j.jenvman.2010.10.026

Skrabal, J. (2020). What Can We Learn from Brownfield Databases? Exploring Specifics of the Location of Brownfields in the Czech Republic. *Geographia Technica, 15*(2), 191–201. https://doi.org/10.21163/gt_2020.152.18

Svobodová, H., & Věžník, A. (2009). To the problems of agricultural brownfields in the Czech Republic – Case study of the Vysocina region. *Agricultural Economics (Czech Republic), 55*(11), 550–556. https://doi.org/10.17221/1159-AGRICECON

Syms, P. (1999). Redeveloping brownfield land. The decision-making process. *Journal of Property Investment & Finance, 17*(5), 481–500. https://doi.org/10.1108/14635789910294903

Syms, P. (2004). *Previously Developed Land: Industrial Activities and Contamination* (2nd ed.). Blackwell Publishing.

Wiltshaw, D. G. (1998). Stigma, perception and the remediation of contaminated land. *Journal of Property Research, 15*(4), 285–303. https://doi.org/10.1080/095999198368301

Zhong, Q., Zhang, L., Zhu, Y., van den Bosch, C. K., Han, J., Zhang, G., & Li, Y. (2020). A conceptual framework for ex ante valuation of ecosystem services of brownfield greening from a systematic perspective. *Ecosystem Health and Sustainability, 6*(1), 1743206. https://doi.org/10.1080/20964129.2020.1743206